

APPENDIX - CLAIMS

1. (Currently Amended) A method comprising forming an admixture of a solvent,
an additive, said solvent being different from said additive and a conjugated diene polymer selected from the group consisting of a precursor to an electrically conductive conjugated diene polymer and an electrically conductive conjugated diene polymer, said precursor to said electrically conductive conjugated diene polymer said conjugated diene polymer being made electrically conductive by means of a doping reaction;
said doping reaction consisting of exposing said conjugated diene polymer to an acid-containing solution selected from the group consisting of hydrochloric acid, methanesulfonic acid, camphorsulfonic acid and acrylamidopropanesulfonic acid
said conjugated diene polymer being soluble in said solvent,
said conjugated diene polymer not being substantially soluble in said additive in the absence of said solvent;
said additive provides local mobility to said polymer to allow regions of said conjugated diene polymer to associate with one another to achieve a crystalline state; and
removing or partly removing said solvent, substantially leaving said additive therein as remaining additive, said remaining additive provides local mobility to said conjugated diene polymer to achieve said crystalline state thereby comprising a polycrystalline material, said polycrystalline material is characterized by a degree of crystallinity regions and a degree of amorphous regions, said degree of crystallinity regions and said degree of amorphous regions are selected by selecting the composition of said additive, and the amount of said additive;
forming a film via a technique selected from the group consisting of spin-coating or solution casting from said admixture, said resulting film possessing isotropic conductivity.
2. (Canceled) A method according to claim 1, wherein said admixture is electrically conductive and has an isotropic electrical conductivity.

3. (Previously Presented) A method according to claim 1, wherein said additive is selected from the group consisting of plasticizers and diluents.
4. (Previously Presented) A method according to claim 1, wherein said additive is a plasticizer is selected from the group consisting of: Adipic acid plasticizers, Azelaic acid plasticizers, Benzoic acid plasticizers, Citric acid plasticizers, Dimer acid plasticizers, Epoxy plasticizers, Fumaric acid plasticizers, Glycerol plasticizers, Isobutyrate plasticizers, Lauric acid plasticizers, Linoleic acid plasticizers, Maleic acid plasticizers, Sebacic acid plasticizers, Stearic acid plasticizers, Succinic acid plasticizers, Sulfonic acid plasticizers, Terpentines, Terpentine plasticizers, Siloxanes, Polysiloxanes, Ethylene glycols, Polyethylene glycols, Polyesters, Sucrose plasticizers, Mellitates, Myristic acid plasticizers, Oleic acid plasticizers, Palmitic acid plasticizers, Paraffin plasticizers, Phosphoric acid plasticizers, Phthalic acid plasticizers, Ricinoleic acid plasticizers, Tartaric acid plasticizers, Trimellitic acid plasticizers, Glycol plasticizers, Glycolates, Hydrocarbons, Phosphonic acid plasticizers, and Polysilanes.
5. (Previously Presented) A method according to claim 1, wherein said polymer is selected from the group consisting of substituted and unsubstituted polyparaphenylene vinylenes, polyparaphenylenes, polyanilines, polythiophenes, polyazines, polyfurans, polypyrroles, polyselenophenes, poly-p-phenylene sulfides, polyacetylenes formed from soluble precursors, combinations thereof and blends thereof with other polymers and copolymers of the monomers thereof.
6. (Previously Presented) A method according to claim 1, wherein said solvent, when removed or partly removed forms a film which is further stretch oriented.

7. (Currently Amended) A method of fabricating a precursor to an electrically conductive conjugated polymer and an electrically conductive polymer comprising:

admixing a combination of a first material, a second additive doping material and a solvent:

said first material is selected from the group consisting of a precursors to an electrically conductive conjugated polymer polymer and an electrically conductive conjugated polymer polymer;

said second additive doping material being soluble in said solvent, said second additive doping material not being substantially soluble in said first material in the absence of said solvent;

contacting said first material with said additive doping material to render said first material electrically conductive by means of a doping reaction and providing local mobility to said first material to allow said conjugated polymer polymers to associate with one another to achieve a crystalline state;

removing or partly removing said solvent, substantially leaving said additive doping material therein as a remaining additive doping material, said remaining additive doping material providing local mobility to said first material to achieve said crystalline state thereby comprising a polycrystalline material, said polycrystalline material is characterized by a degree of crystallinity regions and

a degree of amorphous regions, said degree of crystallinity regions and said degree of amorphous regions are selected by selecting the composition of said additive, and the amount of said additive;

forming a film via a technique selected from the group consisting of spin-coating or solution casting from said admixture, said film possessing isotropic conductivity.

8. (Canceled) A method according to claim 7, wherein said combination is electrically conductive and has a conductivity which is isotropic.

9. (Previously presented) A method according to claim 7, wherein said polymer is selected from the group consisting of substituted and unsubstituted polyparaphenylene vinylenes, polythianaphthenes, polyparaphenylenes, polyanilines, polythiophenes, polyazines, polyfurans, polypyrroles, polyselenophenes, poly-p-phenylene sulfides, polyacetylenes formed from soluble precursors, combinations thereof and blends thereof with other polymers and copolymers of the monomers thereof.

10. (Previously presented) A method according to claim 7, wherein said second material is selected from the group consisting of:

Adipic acid plasticizers, Azelaic acid plasticizers, Benzoic acid plasticizers, Citric acid plasticizers, Dimer acid plasticizers, Epoxy plasticizers, Fumaric acid plasticizers, Glycerol plasticizers, Isobutyrate plasticizers, Lauric acid plasticizers, Linoleic acid plasticizers, Maleic acid plasticizers, Sebacic acid plasticizers, Stearic acid plasticizers, Succinic acid plasticizers, Sulfonic acid plasticizers, Terpentines, Terpentine plasticizers, Siloxanes, Polysiloxanes, Ethylene glycols, Polyethylene glycols, Polyesters, Sucrose plasticizers, Mellitates, Myristic acid plasticizers, Oleic acid plasticizers, Palmitic acid plasticizers, Paraffin plasticizers, Phosphoric acid plasticizers, Phthalic acid plasticizers, Ricinoleic acid plasticizers, Tartaric acid plasticizers, Trimellitic acid plasticizers, Glycol plasticizers, Glycolates, Hydrocarbons, Phosphonic acid plasticizers, Polysilanes.

11. (Currently Amended) The method defined in Claim 1 wherein said method consists of a conjugated polymer which is polyaniline which is a substantially crystalline material which is dissolved in a solvent consisting of NMP to form a solution exhibiting bimodal or trimodal distribution in Gel Permeation Chromatography (GPC) as a result of aggregation induced by internal hydrogen bonding between chains in said polyaniline and exhibiting the GPC curve depicted in Figure 4, and said additive is 5% by weight poly-co-dimethyl propylamine siloxane.

12. (Canceled) A method comprising:
providing solution of polymers in a solvent;
said polymers are selected from the group consisting of precursors to electrically
conductive polymers and electrically conductive polymers;
providing mobility to said polymers to allow said polymers to associate with one another
to achieve a crystalline state by adding a plasticizer to said solvent;
said plasticizer being soluble in said solvent. said plasticizer not being substantially soluble in
said polymer in the absence of said solvent.
13. (Canceled) A method according to claim 12, wherein said step of providing mobility is
provided by adding an additive to said solution.
14. (Previously presented) A method according to claim 7 wherein said additive is selected
from the group consisting of a plasticizer and a diluent.
15. (Previously Presented) A method according to claim 1, wherein said additive contains
substituents which facilitate the miscibility of said polymer and said additive.
16. (Currently Amended) A method according to claim 1, wherein said additive disrupts
aggregation of said polymer.
17. - 19 (Canceled)
20. (Previously Presented) A method according to claim 1, wherein said additive
deaggregates said polymer.
21. (Canceled)

22. (Previously Presented) A method according to claim 1, wherein said solvent is extracted from said admixture by a technique selected from the group consisting of solvent extraction and evaporation.

23. (Previously Presented) A method according to claim 1, wherein said additive is first added to a solvent and thereafter an electrically conducting polyaniline is added which becomes neutralized upon addition to said admixture.

24. (Previously Presented) A method according to claim 1, wherein said admixture contains a polyaniline, said additive, and an oxidant.

25. (Currently Amended) A method according to Claim 7, wherein said additive includes a plasticization effect.

26 - 39 (Cancelled)

40. (Previously Presented) A method according to claim 7 wherein said additive is an oxidant.

41. (Previously Presented) A method according to claim 7 wherein said material is an oxidant.

42. (Currently Amended) A method according to claim 7 wherein said plasticizer is an oxidant.

43. - 45. (Cancelled)

46. (Canceled) A method comprising forming an admixture of
a solvent selected from the group consisting of NMP, m-Cresol and a combination of NMP/m-
cresol;
an additive selected from the group consisting of poly-co-dimethyl, amino siloxane, poly glycol
diacid, 3,6,9-trioxaundecanoic acid, poly(ethylene glycol) tetrahydrofurfuryl ether, glycerol
triacetate, and epoxidized soy bean oil.
polyaniline,
said polyaniline being soluble in said solvent,
said polyaniline not being substantially soluble in said additive in the absence of said solvent;
said additive provides local mobility to said polymer to allow said polymer to associate with one
another to achieve a crystalline state; and
removing or partly removing said solvent, substantially leaving said additive therein as remaining
additive, said remaining additive provides local mobility to said polyaniline to achieve said
crystalline state thereby comprising a polycrystalline material, said polycrystalline material is
characterized by a degree of crystallinity regions and
a degree of amorphous regions, said degree of crystallinity regions and said degree of amorphous
regions are selected by selecting the composition of said additive, and the amount of said
additive,
said admixture being electrically conductive and having an isotropic electrical conductivity.
47. (Withdrawn) The method according to claim 53, wherein said solvent is NMP and said
additive is epoxidized soy bean oil.
48. (Withdrawn) The method according to claim 53, wherein said solvent is
NMP and said additive is poly-co-dimethyl, amino siloxane.
49. (Withdrawn) The method according to claim 53, wherein said solvent is
NMP and said additive is poly glycol diacid.

50. (Withdrawn) The method according to claim 53, wherein said solvent is NMP and said additive is 3,6,9-trioxaundecanoic acid.

51. (Withdrawn) The method according to claim 53, wherein said solvent is NMP and said additive is poly(ethylene glycol) tetrahydrofurfuryl ether.

52. (Withdrawn) The method according to claim 53, wherein said solvent is NMP and said additive is glycerol triacetate.

53. (Withdrawn) The method defined in Claim 7, comprising forming an admixture of:

a solvent selected from the group consisting of NMP, m-Cresol and a combination of NMP/m-cresol;

an additive selected from the group consisting of poly-co-dimethyl, amino siloxane, poly glycol diacid, 3,6,9-trioxaundecanoic acid, poly(ethylene glycol) tetrahydrofurfuryl ether, glycerol triacetate, and epoxidized soy bean oil.

polyaniline,

said polyaniline being soluble in said solvent,

said polyaniline not being substantially soluble in said additive in the absence of said solvent;

said additive provides local mobility to said polymer to allow said polymer to associate with one another to achieve a crystalline state; and

removing or partly removing said solvent, substantially leaving said additive therein as remaining additive, said remaining additive provides local mobility to said polyaniline to achieve said crystalline state thereby comprising a polycrystalline material,

said polycrystalline material is characterized by a degree of crystallinity regions and a degree of amorphous regions, said degree of crystallinity regions and said degree of amorphous regions are selected by selecting the composition of said additive, and the amount of said additive.

said admixture being electrically conductive and having an isotropic electrical conductivity.

54. (New) A method comprising forming an admixture of a solvent selected from the group consisting of DMSO, DMF, NMP, dimethylene propylene urea, tetramethyl urea, pyridine, toluene, m-Cresol, phenol, dimethylacetamide, n-cyclohexylpyrrolidinone, 80% aqueous acetic acid, 60 - 88% aqueous formic acid, pyrrolidinone, N1N' dimethyl propyl urea, benzyl alcohol, and a combination of NMP/m-cresol;

an additive selected from the group consisting of Adipic acid, Azelaic acid, Benzoic acid, Citric acid, Dimer acid, Epoxy, Fumaric acid, Glycerol, Isobutyrate, Lauric acid, Linoleic acid, Maleic acid, Sebacic acid, Stearic acid, Succinic acid, Sulfonic acid, Terpentines, Siloxanes, Polysiloxanes, Ethylene glycols, Polyethylene glycols, Polyesters, Sucrose, Mellitates, Myristic acid, Oleic acid, Palmitic acid, Paraffin, Phosphoric acid, Phthalic acid, Ricinoleic acid, Tartaric acid, Trimellitic acid, Glycol, Glycolates, Hydrocarbons, Phosphonic acid, and Polysilanes, said solvent being different from said additive and

a polymer selected from the group consisting of a precursor to an electrically conductive polymer and an electrically conductive polymer,

said precursor to said electrically conductive polymer being made electrically conductive by means of a doping reaction with an acid, said polymer being selected from the group consisting of substituted and unsubstituted polyparaphenylene vinylenes, polyparaphenylenes, polyanilines, polythiophenes, polyazines, polyfurans, polypyrroles, polyselenophenes, poly-p-phenylene sulfides, polyacetylenes formed from soluble precursors, combinations thereof and blends thereof with other copolymers of the monomers thereof;

said polymer being soluble in said solvent,

said polymer not being substantially soluble in said additive in the absence of said solvent;

said additive provides local mobility to said polymer to allow regions of said polymer to

associate with one another to achieve a crystalline state; and removing or partly removing said solvent, substantially leaving said additive therein as remaining additive, said remaining additive provides local mobility to said polymer to achieve said crystalline state thereby comprising a polycrystalline material, said polycrystalline material is characterized by a degree of crystallinity regions and a degree of amorphous regions, said degree of crystallinity regions and said degree of amorphous regions are selected by selecting the composition of said additive, and the amount of said additive;

forming a film from said admixture, said film possessing isotropic conductivity.

55. (New) The method defined in Claim 54 wherein said solvent is cresol, said polymer is polyaniline and said additive is poly-co-dimethyl propylamine siloxane.

56. (New) The method defined in Claim 54 wherein said solvent is NMP/cresol, said polymer is polyaniline and said additive is poly-co-dimethyl propylamine siloxane.

Fig. 5(a) is a Wide Angle X-Ray Scattering (WAXS) spectrum for a polyaniline base film processed from NMP. The polymer film is essentially amorphous. Fig. 5(b) is a Wide Angle X-Ray Scattering spectrum for a polyaniline base film that has been stretch oriented ($1/l_0 = 3.7$). This film was derived from a gel. Fig. 5(c) is a Wide Angle X-Ray Scattering spectrum for a polyaniline base film containing 10% of a poly-co-dimethyl propylamine siloxane. This film is highly crystalline.

Fig. 6 is a schematic diagram of a polycrystalline material as taught in the present invention having crystalline regions (outlined in dotted rectangles) with interstitial amorphous regions.

Fig. 7 is a Dynamic Mechanical Thermal Analysis (DMTA) plot for polyaniline base film cast from NMP. (First Thermal Scan; under Nitrogen)

Fig. 8 is a DMTA plot which represents the second thermal scan for a polyaniline base film cast from NMP; This same film was previously scanned as shown in Fig. 7. Film contains no residual solvent.

Fig. 9 is a DMTA plot for a polyaniline base film cast from NMP and containing 5% poly-co-dimethyl aminopropyl siloxane (5% N content). First thermal scan.

Fig. 10 is a DMTA plot for a polyaniline base film cast from NMP and containing 5% poly-co-dimethyl aminopropyl siloxane (5% N content). Second Thermal Scan (this same film was previously scanned as shown in Fig. 9) Film contains no residual solvent.

Fig. 11 is a GPC for a polyaniline base solution in NMP containing 5% poly-co-dimethyl aminopropyl siloxane by weight to polyaniline. The polyaniline was 0.1% in NMP.